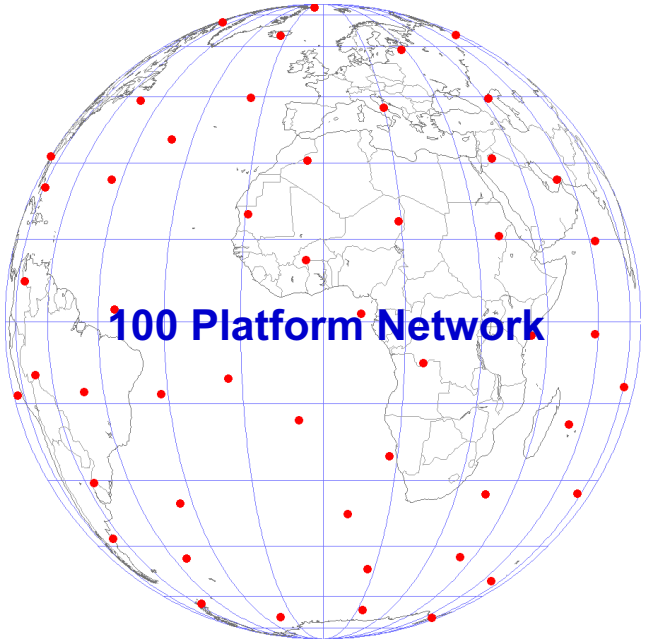
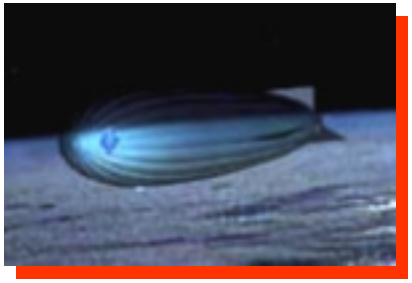
RASC STRATOSPHERIC PLATFORM EARTH SCIENCE WORKSHOP

STRATOSPHERIC PLATFORM OPTIONS





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Topics

Purpose

Plan

Stated Revolutionary Platform Capabilities

Platform Options

Current / Revolutionary Platform Comparison

Evaluation Criteria

Development Challenges

Summary

Purpose of Briefing

- Discuss future study plans
- Provide you background on existing and revolutionary platform capabilities
- To refresh memories and stretch your minds about platforms beyond what is available today

Plan for Developing Stratospheric Platform Options

- Identify and compare platform options
- Evaluate platform options relative to stated capabilities and Earth science objectives

Platform Identification and Comparison

- Understand science goals as developed by the Earth Science Working Group and the Earth science workshop
- Access literature and research stratospheric platform systems and concepts
- Develop list of potential stratospheric platforms with required capabilities
- Compare candidate platforms to stated requirements
- Consider both present and future capabilities in RASC context

Evaluate Platforms

- Develop objective stratospheric platform evaluation criteria
- Perform trade studies and independent analysis
- Use scaling models for candidate future platforms
- Evaluate the suitability of each potential platform for meeting science goals and requirements developed at the workshop
- Prioritize potential platforms by their suitability for meeting science goals

Revolutionary Stratospheric Platform Capabilities

- 30- to 35-km constant altitude
- 100-day flights (eventually 365 days)
- 1 kW of power
- 200 kg or more payload capacity
- Make in situ measurements between 20-35 km altitude
- Payload recovery at end of flight

Stratospheric Platform Options

Preliminary Filter for Selection of Stratospheric Platform Options

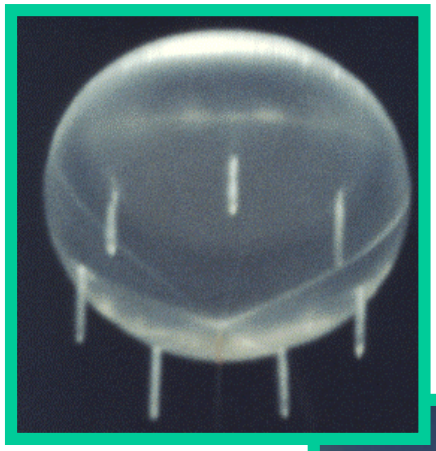
- Sustained flight above 60,000 ft altitude
- Historical, operational, currently under development and/or test and conceptual

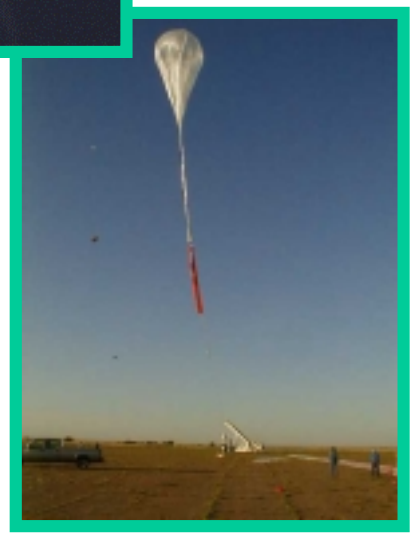
Piloted Aircraft

- Historical
  - SR-71 (stored)
- Operational
  - ER-2
  - U-2
  - WB-57F
  - Mig-25
- Under development
  - Proteus

Balloons

- **Historical**
  - Small super-pressure
  - Racoon
  - Anchor
- **Operational**
  - Conventional zero pressure (ZP)
  - Polar summer zero pressure (LDB)
  - IR hot air (MIR)
- **Under development**
  - Ultra-long Duration Balloon (ULDB) - NASA
  - GAINS Anchor - GSSL
- **Concepts**
  - Advanced Zero Pressure
  - Guided stratospheric super-pressure





Unmanned Air Vehicles (UAVs)

- Historical
  - Perseus B
  - Raptor
  - Altus II
  - Pathfinder
- Operational
  - Global Hawk
  - BQM-34 Firebee
- Under development
  - Helios
- Concepts
  - Theseus B
  - Heliplat

Superpressure Airships

- **Operational**
  - None
- **Under development**
  - Sounder - SRI
  - Stratsat - ATG
- **Concepts**
  - Stratospheric LTA platform - Japan
  - High Altitude Airship - Lockheed+
  - High Altitude Long Endurance (HALE) airship- ESA

PLATFORM COMPARISON -1

Current Earth Science Platforms	Mission Duration	Science Instrument Capability, kg	Typical Altitude, km	In Situ Measurements (20-35 km)	Power to Instruments, W	Payload Recovery at End of Flight
Polar Sun Sync. Satellites	10 years	200-800	800	No	200-1000	No
Moderate Incl. Satellites	10 years	200-800	500	No	200-1000	No
Stratospheric Balloons	3-10 days	2000	35	Yes at float altitude	600-1000	Mostly
Stratospheric Balloons - Polar	10-33 days	1000	35	Yes at float altitude	600	Mostly
IR Balloons	20-70 days	10-50	17-28	Yes over oscillation range	50	No
Stratospheric Aircraft	<1 day	860-1650	20	No	1300-7000	Yes (Piloted) Mostly (UAV)
Radio/Drop Sondes	*2 hours*	*0.1*	*Radio to ~30 Drop from 20*	*Yes to ~30 (Radiosondes)*	*0.05*	*No*
Revolutionary Earth Science Platform	100 days to 1 year	200 or more	30-35	Yes	1000	Yes

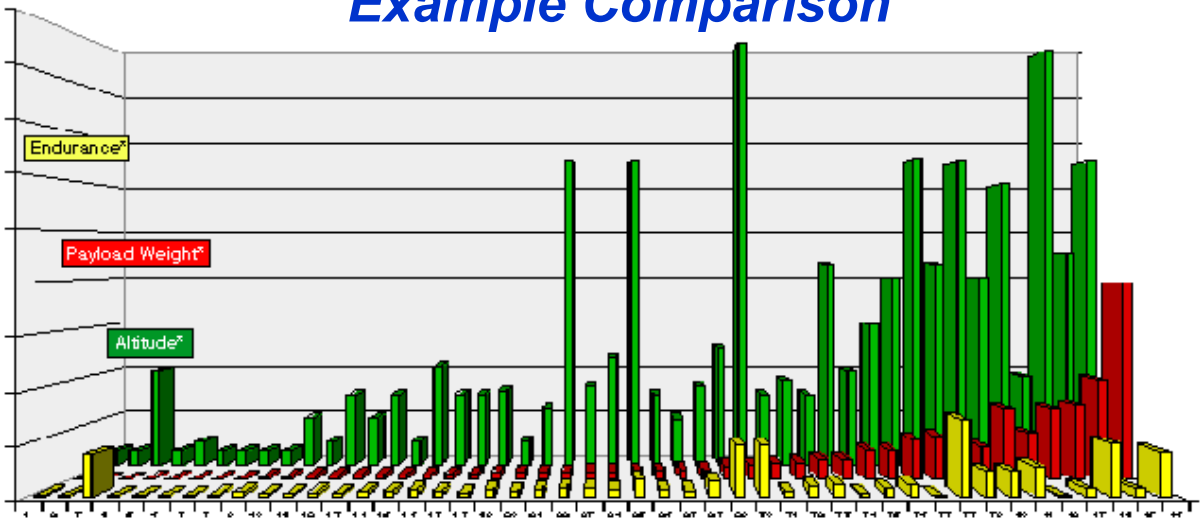
PLATFORM COMPARISON -2

Current Earth Science Platforms	Coverage	Site Coverage Duration	Diurnal Coverage	Surface Speed, m/s	"Air" Speed, m/s	Vertical Coverage	Resolution of Vertical Profiling	Surface Resolution (1° FOV), km	Signal-to-Noise Ratio
Polar Sun Sync. Satellites	Global	minutes	Two times of day	7,452	7,466	TOA to Surface	1-5 km	14.0	Low
Moderate Incl. Satellites	No polar	minutes	Day and night	7,613	7,627	TOA to Surface	1-5 km	8.7	Low
Stratospheric Balloons	Regional	hours	Day and night	0-50	<0.01	TOA to Surface	0.1 to 1 km	0.6	High
Stratospheric Balloons - Polar	Regional	hours	Day only	0-50	<0.01	TOA to Surface	0.1 to 1 km	0.6	High
IR Balloons	Regional	hours	Day and night	0-50	<0.01	20 km to Surface	0.1 to 1 km	0.3-0.5	High
Stratospheric Aircraft	Specific Site to Regional	Up to 24 hours	Day and/or night	0-200	15-180	20 km to Surface	0.1 to 1 km	0.3	High
Radio/Drop Sondes	*Specific Site*	*2 hours*	*Day and/or night*	*0-50*	*3-5 vertical*	*Surface to 20 km*	*0.01 km*	*N/A*	*High*
Revolutionary Earth Science Platform	??	??	??	??	??	??	??	??	??

Platform Evaluation Criteria - 1

- **Meets science requirements**
- **Payload capability**
  - Size or performance
  - Altitude
  - Duration
  - Range
  - Speed
  - Power availability

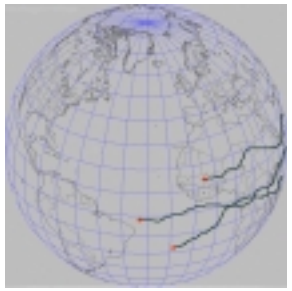
Example Comparison



- **Gross platform size and mass**
  - Larger systems carry more payload and cost more
- **In situ measurement ability**
  - Too slow or too fast
  - Vertical velocity

Platform Evaluation Criteria - 2

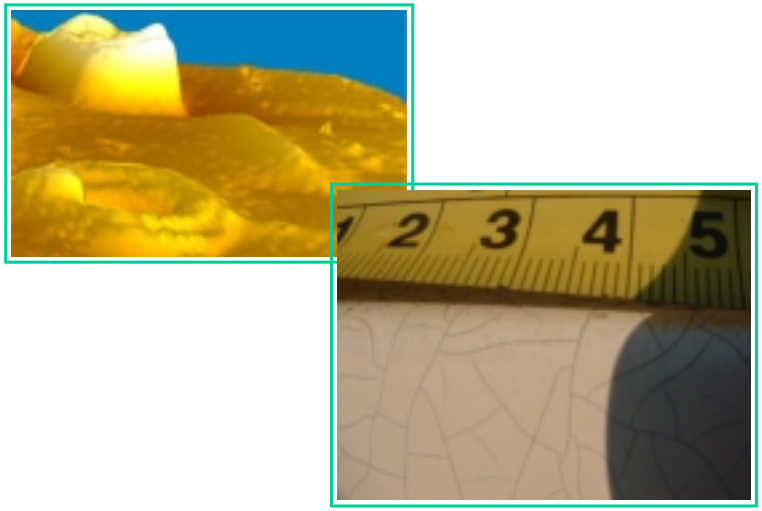
- **Launch, operations and payload recovery**
  - Launch complexity
  - Weather and seasonal limitations
  - Solar illumination
  - Facilities needs
  - Air traffic control limitations
  - International overflight
  - Human, property and payload safety requirements
  - Landing site geography

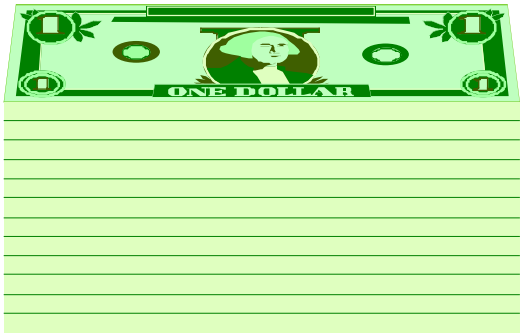


- **Flight path control**
  - Position and attitude control requirements
  - Seasonal and latitudinal wind effects e.g. station-keeping
  - Formation and network control ability

Platform Evaluation Criteria - 3

- Reliability
- Airborne life-limiting factors
  - UV degradation of materials
  - Consumables
  - Hardware failure
- Life-cycle costs
  - Platform research, development and testing
  - Recurring and replacement
  - Operations and disposal





Potential Platform Development Challenges

- Long-duration flight in stratospheric environment
- Platform flight path control
- Launch location and launch time flexibility
- Reliable operation and payload recovery
- Precise orientation and pointing knowledge
- Payload power
- Low life-cycle cost

Summary

- Potential candidate stratospheric platforms are being identified
- No current platform has all stated capabilities of revolutionary stratospheric platform
- Pathways exist and development is ongoing for several platforms that could have the potential to meet stated capabilities
- Criteria for evaluation of platform options are being developed
- The ability to meet Earth science requirements will be a key element of the planned platform evaluation
- Platform development challenges identified